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ABSTRACT

This report describes a program for improving the transfer of the learning of different techniques used in computer applications. The targeted population consisted of sophomores and juniors in a suburban high school in a middle class community. The problem was documented through teacher surveys, student surveys, anecdotal records and behavioral checklists. Analysis of probable causes revealed that students lack motivation, have an inability to organize their thinking, and lack confidence and prior knowledge of computer applications. Faculty reported that students have inability to share ideas and knowledge, that they easily give up on a problem, and have difficulty transferring techniques from one problem to another. A review of research literature suggested that students are not taught how to transfer and that transfer will happen on its own. Students do not have a mental working model of the actual workplace setting and do not understand how their present learning will transfer into a real world problem. A review of solutions strategies by researchers in the field, combined with an analysis of the problem setting resulted in the selection of three major categories of intervention: provide a real world problem for the students to solve, demonstrate computer application techniques that transfer from one application to another, and make the students more aware of their own thinking. Post intervention data indicated that the targeted students demonstrated an improvement of their transfer of learning skills. (Contains 26 references.) (AEF)

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IMPROVING TRANSFER OF LEARNING IN A COMPUTER BASED CLASSROOM

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Saint Xavier University & Skylight Professional Development

Field Based Masters Program

Chicago, Illinois

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DEDICATION

I would like to dedicate this paper to my wife, Ruth and my children,

Lauren, Rachel and Jessica.

Because of them, I am the richest man on the planet.

ABSTRACT

This report describes a program for improving the transfer of learning of different techniques used in computer applications. The targeted population consisted of sophomores and juniors in a suburban high school in a middle class community. The transfer of learning problem was documented through teacher surveys, student surveys, anecdotal records and behavioral checklists.

Analysis of probable causes revealed that students lack motivation, have an inability to organize their thinking, as well as confidence and prior knowledge of computer applications. Faculty reported on student inability in not sharing ideas and knowledge, that they easily give up on a problem, and have difficulty transferring techniques from one problem to another. Review of research literature suggested that students are not taught how to transfer but rather that transfer will happen on its own without help. Students do not have a mental working model of the actual workplace setting and do not understand how their present learning will transfer into a real world problem.

A review of solution strategies by researchers in the field of education, combined with an analysis of the problem setting resulted in the selection of three major categories of intervention: provide a real world problem for the students to solve, demonstrate computer application techniques that transfer from one application to another through bridging, and make the students more self aware of their own thinking processes, metacognition, as the students are solving real world problems.

Post intervention data indicated that the targeted students demonstrated an improvement of their transfer of learning skills. The students bridged their learning from creating a personal web site to completing a web site for the resident community. Through this process, the students became aware of how learning in the classroom can be applied to a real world problem.

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CHAPTER 1

PROBLEM STATEMENT AND CONTEXT

General Statement of the Problem

The students of the targeted sophomore, junior and senior class exhibit a difficulty displaying transfer of learning. Students taught the function of a tool in a computer application have difficulty creating original designs that go beyond the simple application of the tool. The evidence that this problem exists for these students includes teacher surveys, student surveys, anecdotal records, and behavioral checklists.

Immediate Problem Context

The targeted sophomores, juniors and seniors are located in a four year single district public school. According to the 1997 School Report Card, this school has a total enrollment of 2,038 students, comprised of 67.9% Caucasian students, 20.1% African-American students, 9.2% Hispanic students, 2.2% Asian/Pacific Islander students and 0.7% Native American students. The average class size is 19.1 students.

Students from low income households was 14.0% of the population. Limited-English-Proficient students made up 0.5% of the population, and the Dropout rate was at 8.7% over four

years. Attendance for the school on a daily basis was 87.8%, the Student Mobility rate was 17.9%, and the Chronic Truancy rate was 3.2%. The number of Chronic Truants was 62 students in the last 180 days of school. The graduation rate of the school for the 1996-1997 school year was 74.4%.

Illinois Goal Assessment Program (IGAP) tests were administered to the sophomore and junior class. The sophomores were tested in Reading, Mathematics and Writing. Juniors were tested in Science and Social Sciences. The Sophomore IGAP scores were: Reading 198 (State 208), Mathematics 235 (State 264) and Writing 26.0 (State 26.1). The Junior IGAP scores were: Science 232 (State 260) and Social Sciences 216 (State 245). In each of the areas tested, the scores of the sophomores and juniors were below the state average.

An analysis of Teachers by Racial/Ethnic Background and Gender shows that 88.1% were Caucasian, 8.3% were African-American, 2.8% were Hispanic and 0.9% were Asian/Pacific Islander. Males made up 56.4% and females made up 43.6% for a total of 109 teachers in the high school. The average teaching experience for the district was 16.7 years. The number of teachers with a Bachelor's Degree was 29.4% and the number of teachers with Master's and above was 70.6%. The Pupil-Teacher Ratio was 20.8:1 and the Pupil-Administrator Ratio was 291.1:1. The organizational structure of the school district was comprised of a unifying school board from the three feeder districts, one superintendent, a principal, an assistant principal, and three deans of students.

This school has a diverse and rigorous curriculum that combines traditional academic areas with integrated, cutting-edge technology into the classrooms. During the summer of 1997, the school completed the wiring of a ethernet network and the placement of computers with internet capabilities in every classroom. Along with 15 other schools in the United States, this school is piloting a laptop initiative in partnership with Microsoft and Toshiba. This site will be

recognized by Toshiba with an international award recognizing the laptop initiative. This initiative has grown from one "block" class to having five roving laptop carts that can be wheeled into the room and plugged into the network. This networking ability allows internet access for the students in the classroom. Engaged Learning projects are being created by staff from cross-curricular areas integrating subject matter and combining the best teaching practices. As a leader in technology and recognized as a model school in regards to technology integration, this school has received state technology grants totaling $310,000 so far and is moving forward into the 21st century preparing the students with the academic and technology skills that the students will need to be successful in a technological world. All of this technology is a wonderful thing, but, as the process of training the students in the software applications begins, it has been noticed that many students are having trouble transferring their knowledge of the tools provided in the software and applying these tools into creative projects.

Surrounding Community

This community is located at the most northeastern section of the state and was originally founded by an Evangelical preacher in the early 1900's. The founder's dream was to create a utopia of Christian living. The founder saw that it was necessary to create a self sustaining town with industry and higher education for all of the people that lived in the community. The town was founded on basic Christian principles to provide a framework for all social decisions and even today, Christian principles permeate the community. This town has a higher number of churches per capita than any other town in the state. This diversity of churches presents unique situations for the school as it attempts to provide services for all of the families. The local high school has developed a very strong parent network that unifies families from different socio-Christian backgrounds working toward a common goal of helping all of the students be successful in school. The parent network also organizes social events outside of school that bring

together people in the community that do not have children in school. This group believes that strong parent involvement is important to the success of the students. The school seeks the input from all of the town's ministerial groups so that the churches and community can work together to improve student achievement and participation.

A cookie factory operated in the community for nearly 80 years before it closed in the late 1980's, and now the nuclear plant is closing and leaving the schools with substantial loss in taxes that supported the school. Many families that work at the plant are currently facing employment decisions that will impact the community. There are 56,800 households with an average mean income of $38,000.00 and 30% of these families have children in their household (Lake County Directory, 1997). New issues will be facing the community in the coming years. With the strong support of the churches, school and the parent network, this community will be able to meet the needs of the changing economic climate.

National Context of the Problem

"In the mid 19th century, the teacher still stands before the classroom as the sage dispensing knowledge. In most classrooms today, the sage still stood before the classroom as the sage dispensing knowledge. In the meantime, the computer has created an information explosion, shrunk the globe, and changed how most people do their jobs" (Costa, Bellanca & Fogarty, 1992a, p. 1). The challenge facing teachers today is that they are no longer the sage dispensing all information; instead, the teacher now must become a guide and facilitator to help the students gather and assimilate all of the information that is available to them.

The process of educating the students in computer technology, specifically in the use of computer applications, is a challenge. Students will need to transfer their learning in the classroom and apply it to technologically challenging enterprises. The concept of transfer basically comes from the psychological literature on learning theory, the use of knowledge or

skills acquired in one context and applied directly in another different context (Cromier & Hagman, 1987). As an educator, the art of transfer becomes an important educational tool that must be taught to the students. Teachers need to create students that will be life long learners, learning new skills and transferring this learning into their professional lives outside of high school.

Schools need to create a work force that can evolve as the market place evolves and changes. "For any nation to be competitive in the global economy of the 21st-Century, it will need a workforce prepared to use 21st-Century work tools"(Costa, Bellanca & Fogarty, 1992a, p. 2). They must put into place a system that can train staff and students. For example, classes that teach how to weld or fabricate different products now need to train the students in different areas where technology has entered into the trade. Advances in software are the most surprising. Areas of artificial intelligence, bio-engineering, micro-systems and robotics have ramifications on the basic daily living of every individual. Learning now takes on a different meaning than it did 50 years ago. "As information multiplies at rates faster than we can imagine, the need for a primary focus on learning how to learn becomes preeminent"(Costa, Bellanca & Fogarty, 1992b, p. 16). Schools now face the task of preparing students for a different and more advanced workplace. "Today industry requires a flexible work force to cope with rapid technological and economic change to improve economic viability. Knowledge and skills are expected to transfer to new tasks and situations"(Misko, 1995, p. 1).

Teaching in the classroom takes on new importance as schools try to meet these new needs. New skills in communication, planning, teamwork, and collecting, organizing and analyzing information are additions to the core curriculum that need to be addressed. The classroom where curriculum needs are met must also provide opportunities for positive transfer to occur. More positive transfer through different assignments and experiences will allow the individual to move

to high road transfer. High road transfer provides learning opportunities that mirror work that will be done in employment areas. Training in the specific skills in which the student is interested must be rigorous enough to provide a good foundation of knowledge in the context area. This context specific area knowledge is the foundation upon which the student can make transfer happen.

The rush of new technology into the schools is providing new opportunities for training. All staff who get the new technology in their classrooms need specific training in context specific areas. Teachers can then transfer this knowledge into their classrooms, to the students, and then into their curriculum. Teachers cannot implement new technology into their classrooms unless they have had the training to make it happen. "Studies of advanced computer programmers all point to the large role that context-specific knowledge and experience play in the ability of experts to solve problems. Experts know more and have developed this knowledge through years of experience"(Misko, 1995, p. 12). Educators will need to begin the process of using and developing different software and hardware applications for use in their classrooms. This practice will make them experts at using technology in the classroom. This practice will also lead to educators that are more confident about their knowledge base and who will be able to work through any problems that arise in project situations.

A more coherent knowledge structure means that experts are also able to think in terms of underlying principles which can be abstracted and used in other contexts. Such findings further underscore the importance of building up knowledge bases for the development of skill and expertise. Although some strategies may help students to be more efficient learners, it is also important for vocational educators to realize that there are few substitutes for knowledge and experience in the development of expertise and the ability to transfer skills to novel settings (Misko, 1995).

CHAPTER 2

PROBLEM DOCUMENTATION

Problem Evidence

Evidence for the existence of lack of transfer of learning among sophomores, juniors and seniors at the site was documented through the teacher surveys (Appendix A), student surveys (Appendix B), anecdotal records (Appendix C), and behavioral checklist (Appendix D). The targeted students who were studied were in a Commercial Art class as part of their art elective.

Student and Teacher Surveys

Student and teacher surveys were distributed to measure the problem of transfer of learning. Seventy surveys were distributed to the staff with 56 being returned. Twelve students in the targeted class were given the survey. A summary of the data is represented in Table 1.

This table shows that the teachers recognize that transfer is a problem for the students. Staff members that responded to the sometimes category responded that there are areas where transfer is a problem but not an overall problem. Of the teachers that responded to the survey, a majority of teachers specifically identified that students in their classrooms lack the ability to transfer their learning.

While the teachers said that the students lacked the ability to transfer their learning, only two of the students in the identified class said that they had trouble transferring their learning. The data shows that the teachers recognize the problem while the students do not recognize they lack this ability or do not know what transfer of learning means.

Table 1

Results from Student and Teacher Surveys Regarding Transfer of Learning

	Yes	No	Sometimes
Transfer is a problem for the students			
Teacher	27	6	23
Students lack of transfer			
Teacher	25	5	26
Student	2	5	5
Trouble transferring techniques in computer applications			
Teacher	23	6	27
Student	2	5	5

Another area that was identified by the teachers as a problem is the students ability to transfer their learning of different techniques from one computer application to another. The teachers who use technology in their lessons identified transferring techniques as a problem for the students. The students responded that it was not a problem but the work that they are turning into their instructors must exhibit a lack of transfer while using technology during their lesson. The results from the survey provide evidence that the students are having difficulty in transferring their learning. Results from the behavioral checklist further support this claim.

Anecdotal Records and Behavioral Checklist

The anecdotal record form had target areas which the instructor used to identify areas where classroom situations created an environment that was not conducive to transfer of learning. As the classroom is a computer lab and computer application instruction was the main curriculum, the form was set up to identify if students were using the tools demonstrated correctly during the lesson, and whether the students were sharing their learned information with other students in an appropriate manner. After the instruction segment of the lesson was completed, the instructor identified on the record form which students had problems and which students did not. This anecdotal form was kept on a daily basis, and the instructor included reflections on the day's lesson. The reflections of the instructor indicated that the current educational practices being used were not adequate to promote transfer. Before the instructor began the intervention strategies of the project, the instructor recorded problems in the classroom that were interfering with transfer of learning. The most common problems identified in the anecdotal record form in the first two weeks of the class were students displaying inappropriate emotions when faced with a problem, acting impatient while waiting for help, and frequently putting-down other students. Results from the anecdotal record also showed that the students did not share their knowledge with other students, experiment independently with the tool demonstrated during the lesson, and had difficulty transferring the tool function to another problem. The anecdotal records showed that over the first two weeks that specific behaviors were causing a transfer problem.

Behaviors were also recorded using a behavioral checklist. The instructor used the behavioral checklist to identify specific behaviors that interfered with the students' ability to transfer their learning. Behaviors such as listening, sharing, and helping other students stay on task were identified each day of instruction prior to any intervention. It became apparent to the instructor that transfer would not occur unless the students' behavior was changed in a positive

direction. There are causes for the lack of transfer that the students are exhibiting during their work in the class. The instructor observed that unless shepherding, changing the educational practices in the classroom, and providing experiences that pertain to the workplace, transfer of their learning would not occur. The following section further describes probable causes for why transfer of learning will not occur.

Probable Causes

Five major factors have been found which appear to interfere with students transfer of learning, the "Bo Peep Theory" (Costa, Bellanca & Fogarty, 1992b, p. 203), student attitudes and behavior towards transfer, students view of the workplace, students prior learning, and changing technology.

Bo Peep Theory

First, in order to fully comprehend the probable causes for the lack of transfer of learning, it is important to understand what areas need to be addressed for positive transfer to occur. It is the hope of all educators that students will take the knowledge taught to them in the classroom and apply it into an authentic and realistic situation that is unique and different from the original learning. Many are under the assumption of "The Bo Peep Theory" (Costa, Bellanca & Fogarty, 1992b, p. 203) leave them alone and they'll come home wagging their tails behind them. This theory of transfer assumes that the knowledge and skills a person has learned will "come home" to wherever it is needed. It is not that anyone advocates that transfer takes care of itself; rather, everyday practice presumes that it happens (Costa, Bellanca & Fogarty, 1992b). The feeling that students have learned the information and it will automatically be applied to a new situation is a misnomer. The age of the students enrolled in class make no difference on the effects of transfer. "Participants in adult education programs often acquire knowledge and skills but fail to transfer them. The new behaviors are packaged and put on the shelf after program completion. Failure to

transfer newly acquired behaviors is caused by multiple factors including the educational intervention, the learner, and the transfer setting" (Cheek & Campbell, 1994, p. 27).

Students Attitudes and Behaviors in Classroom Towards Transfer

The second probable cause can be found by looking at the students' attitudes and behaviors in the classroom. "Reasons which affect the ability of the student to transfer learning include motivation, confidence, original learning, prior knowledge"(Misko, 1995, p. 15). Frequently students will ask "where will I ever use this in real life." This phrase has been heard many times by the instructor and by staff members in the science, history and mathematics departments. The instructor also recognized through the reflections in the anecdotal records that it would be necessary to show the students a real life working experience. Students are not connecting their prior learning and confidently applying that knowledge to new situations. Without connections to outside problems, the students cannot transfer their learning and will not gain new confidence to try other problems. "Many students are not adaptive learners, programs should focus on preparing students to be good adaptive learners, so that they can perform effectively when situations are unpredictable and tasks demand change"(Resnik, as cited by Cordiero & Campbell, 1996, p. 3). Projects given to the students in class do not allow for adaptive behavior. The outcome of the project is predictable. Many projects are not created with constant changes thrown at the students at different intervals. Students are not trained to organize their thoughts and processes.

There is also an "inability for students to organize their thinking, the students need to learn the skills to develop existing knowledge and how to deal with a problem situation at a different time and place"(Moursund, 1993, p. 15). Students do not have to organize any of the projects from scratch. Outlines and details are specified by the teacher and all they have to do is follow the directions given. Existing knowledge of how projects are organized should be drawn

out by the students as the projects continue throughout their class. Students need to begin to reflect on this existing knowledge and develop projects. Unfortunately the use of drill and practice work is still largely used by the faculty at the site. The instructor also recognized through the reflections that many of the projects in the classroom were also drill and practice lessons for the computer applications being learned, and that the students never did any reflections of their own on any of their project work. They will not transfer the material if all they do is drill and practice work.

There are four main causes reported by Bellanca and Fogarty (1991) for the inability of students to transfer learning: first, drills and practices are used too often in the classroom instead of metacognitive classwork; second, recall drills make up 90 percent of the instruction; third, little class discussion exists, and fourthly, curriculum is not consistently followed. The students will depend on the teacher to create a learning environment that steers from these practices to make their learning connect to other problems. Students cannot make connections without examples of areas where they can transfer their learning. Drill and practice lessons do not demonstrate for the students where they can apply what they have learned. The instructors reflections showed that the classroom environment needed changing to steer the learning in directions that would promote transfer and lessons needed to be designed so that the students could demonstrate what they have learned. Students need to acquire their knowledge in such a way that transfer of learning will be achieved.

"Some theorists contend that faulty assumptions about the nature of knowledge and how it is acquired are at the root of problems in achieving transfer of learning" (Thomas, Anderson, & Getahun, 1992, p. 20). Acquiring knowledge by creating problems that rely on prior knowledge will help the students transfer their learning. Students in the classroom can make connections from their prior knowledge to new problems in a classroom if they are motivated in challenging

ways. "An individual may or may not be motivated to look for commonalties in previous and subsequent tasks" (Bloom, as cited by Misko, 1995, p. 16). Any task that is assigned in class should make a link to other tasks to demonstrate transfer. "Include learners in the process. Although the need to involve learners in the planning process is a widely accepted principle of program planning, it is especially useful when designing education to foster the transfer of learning. Transfer of learning will be difficult if the learner is not part of the process in developing the program" (Fox, 1994, p. 24). Many projects with the students at the site are not designed around student interest but are developed from lessons that the students worked on in previous introductory art classes. This does not allow for student participation in what they will be doing in the classroom. Student interest and participation in the process of project development will give the students confidence that they can complete the assignments.

"Confidence in one's ability to apply skills learned in previous situations to new tasks is important for transfer of learning to be activated" (Misko, 1995, p. 16). In many adult education programs, however, participants come with varied backgrounds, experience, and needs, and each will apply learning in his or her own setting. Because these settings differ in their specific conditions, simulations would not have much carry over to the real world. "Classroom settings unlike settings at work, home, or community thus, actually impede transfer of learning" (Nolan, 1994, p. 26). The students need to work at computers that are used by people in the design and graphic industry. Having similar technologies for the students to work on fosters confidence and exploration of different programs and designs at school and home. "Sometimes learners choose not to use something new- these learners sometimes unintentionally overlook an opportunity to apply something in an new context" (Costa, Bellanca & Fogarty, 1992a, p. 351). Students that do not have the opportunity to use common technology in the classroom will not be able to transfer

any learning to the new environment. Educating students without the proper technologies will not give a true picture of the modern workplace.

Students View of the Workplace

Students do not have a mental working model of the actual workplace setting. It is believed that more learning will be transferred to the workplace if a problem based learning approach to teaching rather than a lecture/discussion approach is the main focus of preparation programs (Cordiero & Campbell, 1996). Students sit in their classroom and do not engage in workplace related tasks. Subsequently, the students do not have a clear picture of that environment. The instructor at the site recognized through the anecdotal records that this was lacking in the educational experience of the students in this setting. The students are given predefined tasks with outcomes pre-selected. The students only have to think of the task at hand and do not see any transfer of the work at that present time to any future task that might appear in a workplace setting. Many of the students are in a vacuum, getting no real workplace stimulus.

"Transfer does not occur in a vacuum. A broad range of questions, concerns, and problems will occur as individuals interact with new learning, other people, and their environment. Time and distance from the educational experience, the risks of adopting new behaviors, and a lack of readily available resources complicate the transfer process" (Kiener, 1994, p. 28). A classroom should give the students the opportunity to work with others to experience the dynamics of groups and consensus making. Students cannot learn new behaviors if they do not interact with others. Reflections and behavioral checklist feedback of the instructor at the site also recognized that the students needed skills to collaborate with one another on their projects. If the students are learning new information and do not have the opportunity to interact with other students, they will retain little of the information. Learning in the classroom should make a connection to a workplace situation as soon as possible for transfer to be gained. If this

prior learning experience is not provided for the students, working with groups and building new behaviors, it will be difficult for the students to transfer their prior learning knowledge.

Students Prior Learning Aides Transfer

"Prior knowledge is information which cues problem-solvers to strategies and information that will give them the correct results. A comprehensive account of empirical studies which examine how prior knowledge improves performance in a transfer task is provided by many educators" (Bransford, as cited by Misko, 1995, p. 17). All educators provide learning that they hope they can build on later. Introductory projects need to be created, with original learning in mind. This original learning becomes a foundation to build upon for future work. "The amount of knowledge we first acquire when we first learn a skill can be called original learning. Transfer of learning cannot take place unless formal teaching of skills is first introduced" (Druckman & Bjork as cited by Misko, 1995, p. 16). The original learning in the introductory classes must provide the tactile and visual skills that the students will rely upon. "Thorndike's research led him to conclude that no transfer from one area to another takes place unless the two areas share a number of important common elements" (Costa, Bellanca & Fogarty, 1992b, p. 203). Common elements from their prior learning must connect to future projects for transfer to be successful. Students need to be allowed to explore other areas of interest to allow the transfer of techniques and knowledge into their work. Many students are not given the opportunity to explore on their own, but must remain on the class task and finish it before the class ends so tomorrow they can start over. Site based findings by the instructor indicated that the level of educational practices currently used in the classroom would need to be modified to allow exploration for the students benefit. The current curriculum of the class does not allow for student exploration and curriculum changes would also need to be implemented that connect prior learning to new experiences.

"Transfer of learning will not take place unless a person develops declarative knowledge (content information relevant to a person's job), procedural knowledge (information about contingencies or what to do if certain events occur), and strategic knowledge (information about when and why to use particular knowledge on the job. All three types of knowledge can be quite relevant to defining what needs to be transferred as a function of an educational activity" (Ford, 1994, p. 22). Currently, projects at the site do not give the students direct workplace connections which will give the students the opportunity to experiment in class and gain an attitude of confidence that will allow the students to seek outside employment. Students will not see their learning as beneficial if they cannot readily apply it in a way that is important to them. "Analysis of needs is required for developing programs in which learning readily transfers to the application site, transfer will not occur unless skills learned apply to their work" (Sleezer, 1994, p. 25). As classes are prepared and designed for the students, the plan should also include strategies to prepare the students for the rapidly changing technologies. At the site, classes and budgets are not prepared for the implementation of current technologies while getting rid of the old and out of date. This situation will not prepare the students for a workplace that is ever-changing.

Changing Technology

"Technology has increased the pace of change in today's work environment. The need to teach for transferability of skills is greater than ever" (Olsen, 1993, p. 1). Any student that completes a class should have the necessary skills to be successful in the workplace. Many of the students' at the site do not have the opportunity to use different computer operating systems and machines of differing technological advancements. Exposing the students to all of these differing technologies will build confidence to seek employment in any area where the use of technology

is used. Employers will not seek candidates who cannot demonstrate flexibility between platforms and operating systems.

Many students will ask teachers how will they use the information in the classroom in the real world. Teachers must plan for transfer in their classrooms. Many different factors have been identified that hinder the transfer of learning in the classroom including, classrooms full of drill and practice assignments, motivation of the student, confidence to apply their newly learned skills to a new problem, classroom settings that do not mirror the workplace, and not having the current technologies available for the students to use. Teachers need to provide the learning and educational experiences in the classroom that are enhanced with the current technology, mirror the workplace, and that motivate and give the students confidence in their abilities. Fortunately there are strategies that can be implemented in the classroom that will enhance the transfer of learning.

CHAPTER 3

THE SOLUTION STRATEGY

Literature Review

The goal of any educator is for the students to apply the learning from the classroom to a real world situation. Teachers want students to be lifelong learners. Life long learning is necessary because learning also occurs in the workplace and employees need to apply their new skills to their jobs. Transferring their learning from the classroom to real world problems can be enhanced by several different strategies that can be implemented in the classroom. Research has shown that providing some sort of strategy or thinking frame can help promote transfer (Alexander & Judy, 1988; Benderly, 1989; Perkins, as cited by Olsen, 1993). Many different strategies can be implemented to help with the transfer of learning. Bridging, Hugging, The Good Shepherd Theory, "Somethings", High Road and Low Road Transfer, as well as the use of reflections, portfolios and real world problems are strategies that teachers can use to improve transfer of learning.

Bridging

The first strategy or thinking frame is bridging. Bridging means the teacher helps the students build a bridge from the context of learning to other contexts of potential application (Bellanca, 1992; Bellanca & Fogarty, 1991; Bellanca & Fogarty, 1992; Perkins & Salomon, 1988; Perkins & Salomon, as cited by Thomas, Anderson, & Getahun, 1992). As the students begin the process of learning their first graphics application, the students are asked to create their design on paper first. For instance the paper can be used as an analogy. Use of analogies has also been shown to promote transfer (Brown & Kane, 1988; Clark & Voogel, as cited by Olsen, 1993). Once the student has the design complete, the student can take this concept and create it on the computer. The students will build a bridge between the paper work and the computer work. This will take the learning situation and make it more like the real work. This learning situation will create a hugging effect for the learner.

Hugging

A second strategy is hugging. Hugging is to make the learning situation more like the situations to which transfer is desired (Bellanca & Fogarty 1991; Bellanca & Fogarty, 1992; Fogarty, Perkins, & Barell, as cited by Perkins, 1987; Perkins & Salomon, 1988). The students are given specific exercises that develop the skill of using a graphics tool demonstrated in class. These exercises "hug" instruction given in class and promote transfer of what they see demonstrated to what they will actually be doing. It is important for instructors to work with the students to guide them in their work and provide opportunities for them to reflect on what they have done. The instructor who provides this type of instruction is shepherding the students, watching out for their learning and guiding it in the proper direction.

The Good Shepherd Theory

Third, the good shepherd theory notes that when transfer is provoked, practiced and reflected on, transfer is fairly easy to get (Bellanca & Fogarty, 1991; Bellanca & Fogarty, 1992; Perkins & Salomon, 1988). It will be necessary for the teacher to provide and identify areas where transfer will occur. Teachers need to watch over their flock of students to make sure that they are provided for in this area. During the demonstration section of the class, the students should be asked to practice,what the teacher has demonstrated. Students should be asked to think specifically about how the tool works and the specific sequence of actions that need to be taken. The students need to know where the thing they learned can be applied to somewhere in their project.

Something, Somehow, Somewhere

Fourth, there is the strategy that there are something's that we somehow want to use somewhere. This is a graphic of how to take information learned and apply it to the place where it will be of benefit (Bellanca & Fogarty, 1992; Perkins & Salomon, 1988). Posters that students can look at will help give them visual clues. These visual clues promote the students thinking so the student can use what they have learned in a new context. The "Somethings" include; knowledge, concepts, skills, attitudes, principles, disposition and criteria. Students will acquire the knowledge of the application tools in a computer program, while the instructor provides exercises that sharpen their skills. The "Somehows" include Bridging - High Road strategies. This includes anticipating applications, parallel problem solving, generalizing concepts, unpacking analogies and cultivating metacognition. Here the students take their knowledge and begin the process of creating original designs, exploring the limits of the different tools and skills they have learned. The "Somewheres" include areas within content, across disciplines and into life. As the students work on projects, assignments should be given that will include specific

content from areas other than the classroom. A good example is for the students to make projects that advertise events in the community. This type of project will take their content learning into other areas outside of the classroom. This application of content learning will create high road transfer situations for the learner.

High and Low Road Transfer

Finally, the High Road and Low Road transfer strategies (Bellanca & Fogarty, 1991; Bellanca & Fogarty, 1992; Perkins & Salomon, as cited by Thomas, Anderson, & Getahun, 1992) describe how information should be taught to the students and which ways the information can be applied so that ultimately all learning is high road transfer. Low Road transfer takes skills into immediate practice matching lesson to target outcomes. As the teacher shepherds the students to enhance their transfer, he or she needs to take the computer application demonstrations and direct their thinking to reveal how the tools can be used in different graphics that they create. The students own thinking can provide an opportunity to help them transfer their skills.

Reflections

Self – awareness of one's own thinking processes (metacognition) also seems to aid in transferring skills (Bellanca & Fogarty, 1992; Brown & Kane, 1988; Burke, 1994; Clark & Voogel, as cited by Olsen, 1993;; Perkins, 1987; Perkins & Salomon, 1988). At the end of class students are asked to write reflections (Bellanca & Fogarty, 1992; Thomas, Anderson, & Getahun, 1992) on the instruction and demonstrations in the classroom as well as their own learning. Personal reflection on the skills is a critical habit. Students should be asked to record feedback on a reflections and feedback sheet (Cordiero & Campbell, 1996). During these times the teacher directs the students to "think" about areas where they found transfer occurring and

areas where they could not identify transfer. All of the student reflections and examples created can be organized into a portfolio.

Portfolios

In addition portfolios make a wonderful decision making tool. (Mills-Courts & Amiran, as cited by Bujan, et al., 1996). Students that have organized portfolios of their work can use them to make decisions about what areas they are strong in and specific areas that need more work. Their decisions can direct them to relearn information or try different approaches to the same problem. Many times the student will discover new ways to create their work from their previous attempts. As the students work with other students, the students can evaluate what they have done, providing opportunities where the students can share their ideas with one another. The students that use computers to create their work have the opportunity to organize it into an electronic portfolio. This electronic portfolio can be posted on the internet for others outside of the classroom to see. Adding reflections to their electronic portfolio gives others who view their work insight into how they created their work. Students have to make decisions about what work they should include in their electronic portfolios that demonstrate their learning. Their thinking during this process is a valuable learning experience for the students. Performances or demonstrations of learning are applications of learning and are integral in the learning and transfer process (Burke, 1994). This sharing of information is a new and important factor available to students. Sharing information and feedback journals, and providing an authentic learning experience (Misko, 1995) will promote transfer of learning.

Real World Problems

Transfer of learning works best when students can apply their skills to a real- world problem. Real world problems will also create in the learning situation fidelity to transfer situations (Thomas, Anderson, & Getahun, 1992). Applying their learning from a problem-

solving setting to another within both academic and real world situations (Prentice, as cited by Bujan, et.al., 1996) is major part of this project for the students to create the corporate site for their hometown. This project will stimulate and challenge students (Thomas, Anderson, & Getahun, 1992). The students will learn the process of web site creation in the classroom and transfer the skills they have learned to this project. The leader needs to direct the students learning and provide possible applications or real- life situations for the learning to promote transfer (Bellanca, 1992; Burke, 1994; Perkins & Swartz, 1992).

Educators work very hard at providing learning experiences for their students that will take their learning from the classroom into the work environment. Bridging, Hugging, The Good Shepherd Theory, High Road Transfer, Reflections and Portfolios are strategies that educators can use to achieve this goal. Educators want their students to be life long learners. To be successful in their work environment students need to use and understand these strategies. Educators can design and implement projects that demonstrate these strategies.

Project Objective

As a result of teaching transfer of learning skills, during the period of September, 1998 to December, 1998, the sophomores, juniors, and seniors in Commercial Art will increase their transfer skills, as measured by student surveys, student created portfolio web pages, behavioral checklist and anecdotal records.

Process Statements

In order to accomplish the project objective, the following processes are necessary:

1. Teaching and identifying transfer of learning;
2. Providing instruction with content specific knowledge pertaining to web design;
3. Applying their learning from a problem-solving setting to another within both academic and real world situations;

4. Creating a real world problem for the students to solve.

Project Action Plan

Week 1

A. What is transfer of learning? The goal is for the students to understand what transfer of learning is and how to identify situations where transfer exists.

Introduce transfer of learning and define it.

Discuss areas where transfer exists.

Teach different ways to identify where transfer can occur.

B. Assessment

Teacher anecdotal records.

Behavioral checklist.

Student survey.

C. Time Schedule.

5- 50 minute classes.

Week 2

A. Distinguish between High and Low transfer. The goal is for the students to understand what High and Low transfer is and how to identify ways to improve their different levels of transfer.

Discuss situations where a student uses high and low transfer.

Model and assign student journals.

B. Assessment

Teacher anecdotal records.

Behavioral checklist.

C. Time Schedule

5- 50 minute classes

Weeks 3-8

A. Provide instruction with content specific knowledge pertaining to web design. The goal is for the students to get instruction in the following computer applications that pertain to web page development.

Adobe Illustrator.

Adobe PhotoShop.

Netscape Communicator and Composer.

B. Assessment

Projects completed using Adobe Illustrator.

Projects completed using Adobe PhotoShop.

Web pages created with graphics in Netscape Composer.

Behavioral checklist.

Teacher anecdotal records.

C. Time Schedule

5- 50 minute classes.

Weeks 9-16

A. Create a real world problem for the students to solve. The goal is for the students to transfer their learning of Illustrator, PhotoShop and Communicator and create the two separate web sites, one displaying all of their work created in the class and the other, creating the corporate site for their community.

Creation of the student personal portfolio web site.

Creation of the community web site in cooperation with members of the city council.

Publishing of the web sites on the World Wide Web.

B. Assessment

Personal web site pages.

Personal web site links.

Composition and design of the personal pages.

Community web site pages.

Community web site links.

Participation with city council members.

Behavioral checklist.

Teacher anecdotal records.

Student survey.

C. Time Schedule

5- 50 minute classes

Methods of Assessment

In order to assess the effects of the transfer of learning intervention, student surveys, student created portfolio and community web pages, behavioral checklist and anecdotal records will be used. Teacher anecdotal records will provide feedback on each weeks lesson. Analysis of the students web pages will give the student and teacher feedback on how skills learned in the different computer applications were transferred and demonstrated. The behavioral checklist will identify areas where the students are succeeding or where more learning needs to occur. Student

surveys will provide data regarding improved confidence, learning of transfer skills and understanding the connection of present learning to real world problems.

CHAPTER 4

PROJECT RESULTS

Historical Description of the Intervention

The objective of this project was to increase the transfer of learning for students in commercial art class. The objective was accomplished through different projects and teaching strategies. Transfer of learning was taught to the students in the target group. The students were taught three different computer applications; Adobe Illustrator, Adobe PhotoShop and Netscape Navigator Composer. Each of these applications were used to create material that can be published on the World Wide Web. All students were taught how to use the applications by creating original graphic designs. Assignments were designed to hug projects that the students participated in during the prerequisite art classes. As their projects were completed, their designs were then converted to file formats that are web compliant. Illustrator has the ability to create web compliant formats, each of the students designs had to be converted to this format. The deviation at this point in the plan was due to the time involved in conversion, where a student would only be able to convert two files within the time frame of the class. This process took longer than planned. Many of the computers in the lab lack sufficient random access memory.

Frequently the computers would freeze during the file conversion process. If the computers did not freeze up, the process would take nearly 20 minutes for one of the files to be converted. However, since the students were quickly learning the new process, the instructor was able to maintain the action plan time line. All of their material was then organized into a personal web site using Composer. All of the student web sites were published on the sites web server. Access to each of the students' web sites could be gained through the sites' web address.

During the project, the class received an invitation to visit the commercial art department at a large manufacturing firm in the area. A field trip was planned and the class spent the day at two different sites observing professionals using the same computer applications the students had used in class. The firm showed how they create material for their intranet as well as their internet sites. Many of the students were very surprised to see that what they were learning had real world applications. They also saw that the computers that they were using at school were the same. The students saw a direct link from what they were learning in the classroom to this field of work. The firm was also very impressed with the personal web sites that the individual students had created.

A final project was designed for the students to create the corporate site for the city in which the site resides. The instructor approached members of the governing body for the community and asked if the students in the targeted class could create and design their web site. These members were very enthusiastic about the opportunity and said that they would provide the instructor with the material necessary. The students would have to transfer their knowledge of creating a personal web site to building a much larger web site for the city. During the development of the web site material, members of the governing body viewed the work in progress on the world wide web and evaluated the progress and made suggestions and possible changes by e-mail to the instructor. Material from the city became very difficult for the instructor

to get from each of the cities individual departments, however this provided the opportunity to discuss the frustrations that exist in the business world by anyone attempting to complete a project. As material from the town began to flow in, the students worked on their assigned areas. The instructor noticed that the students could quickly create and link several of the pages within the time constraints of the class. Many of the students wanted more to work on, but the material from the city was slow in coming in to the class and despite several inquiries to different departments, some material for the city web site was never received. Results of the interventions show that despite the problems obtaining material from the city, the students improved their transfer of learning skills.

Presentation and Analysis of Results

During the course of the intervention project the instructor kept records of different behaviors and observable skills using different tools from the computer applications that the students were using. By analyzing these records the instructor observed that the targeted students were improving in their transfer of learning skills. The data collected by the instructor is presented to show that the intervention was successful in helping the students transfer their learning in different areas.

Post Survey

In order to assess the effects of the interventions, evaluation of their personal web portfolios, reflections, and a post survey (Appendix B) were used. The results of both surveys are shown in Table 2. The students indicated that their ability to transfer techniques in computer applications has been increased. The majority of students also reported that transfer is no longer a problem for them. Analysis of the anecdotal records and behavioral checklists also showed that the intervention strategies improved the students' transfer of learning.

Table 2

Comparison of Pre/Post Student Surveys

	Yes	No	Sometimes
Transfer is a problem for the students			
Pre	2	5	5
Post	1	10	1
Trouble transferring techniques in computer application			
Pre	2	5	5
Post	2	8	2

Anecdotal Records and Behavioral Checklists

The instructor at the site kept anecdotal records and a behavioral checklist for all of the students in the targeted class. According to the anecdotal records, occurrences of several targeted areas diminished considerably over the course of the action plan. During the first two weeks of the class the record sheet showed very high numbers of students not sharing their knowledge of the tool function with others in the room, experimenting with the tool on an independent basis and transferring the tool function to another problem. At the end of the project, many of the targeted areas had no notation in them, indicating that the problem behavior was not observed. The students were working with each other without the instructors directions. It was also noticed that there was a change in the environment in the classroom where students would help each other with problems instead of asking the instructor. The students could critique each others work without using put-downs. A sense of team was built within each of the groups that worked on the web site for the city. Many negative behaviors also diminished over the course of the class.

Looking at the data from the behavioral checklist, the first two weeks of the class showed that many of the students used put-downs, asked inappropriate questions and exhibited inappropriate behavior when faced with a problem using the computer application. As the project continued with the different interventions, the instructor noticed less of these behaviors in the class. Near the end of the project, the students were asking very technical questions regarding the use of the different tools and encouraged each other in their attempts to try new design problems. Many of the students made comments about the field trip and expressed a desire to pursue that type of work after college. Several students began to seek advice from the college and career counselor about which schools provided degrees in the area of commercial art and graphic design. Their work became more detailed and demonstrated skills that were not taught by the instructor during the lessons throughout the project.

The instructors reflections also showed a change over the course of the project. During the first two weeks of the class, many mentions of frustrations with students learning the application were noted. The instructor recorded that the students would do only what was shown and not try anything original. The students would quit working when they were faced with a problem and disrupt other students. When the interventions began, the notations of these frustrations decreased while the students were working more and being less disruptive during the class. Notations also indicated that as the students were shown a model of what the assignment should look like, they had less problems creating their designs. The designs created with computer applications were more elaborate that those previously created by hand. The instructor also noted that the web site for the city created by students was also more elaborate than their own personal site. The students transferred their skills very seamlessly from their personal site to the city site. The one notation that kept reoccurring in the reflections was that all of the intervention strategies were working better than imagined.

Evaluation of the students personal web portfolios and their reflections also provided the instructor with verification that the intervention strategies worked. The instructor informally evaluated each personal web site during the class period by checking to see if the images that the students placed on the pages would load, if the links to each page would work and if their links to their reflection page would work. The instructor read the reflections that the student created describing the work it took to create the image and looked for details that showed that the student understood how to create the image and their feelings about how the image looks. By reading the reflection and viewing the images the instructor was able to identify where areas of transfer worked for the student. The instructor also had the students correct problem areas that did not work. Once all of the pages worked correctly, the pages would be up-loaded to the internet server and linked with the class home page. Based on these results, several conclusions and recommendations were made.

Conclusions and Recommendations

Based on the analysis of results, this action research project was a success. Many of the students improved their ability to transfer their learning. The students exhibited greater confidence at the end of the semester towards creating new designs. This new found confidence is based upon their training in the different computer applications, being able to recognize situations where transfer can occur, and that their learning in the classroom has direct impact on their education and employment. The electronic portfolios that were created by the students provided a way for the students to display their work and reflect on how they created their designs. Also, the portfolios can be used by the students as a means to demonstrate their level of expertise in a particular computer application. For the students who desire to further their education in the computer graphics area, school admissions members will be able to evaluate the students learning and growth based on their designs and reflections. Students who began to ask

the college and career counselor for further education advice, the counselor affirmed the students that their electronic portfolio was an added feature that may make them a more desirable candidate for admission. The students displayed effective social skills that enhanced the classroom environment and facilitated transfer of learning.

It is the recommendation of the instructor that the implementation of different strategies be used to improve students transfer of learning. A real world project will provide an experience where the students class work will have significance. The addition of a field trip to a firm that does the same kind of work will provide a framework for the students to see the relationship between their classroom learning and the work place. The classroom environment should simulate the workplace. The computers and software that the students use should also be what is used in the real world. It is recommended that any material the students will be using from an outside source be completely gathered before the project begins. The instructor experienced frustration in gathering material from various sources during the final project created by the class. Many of the students also experienced this frustration. Even though this is seen as a negative, positive learning was created. Students learned first hand the positives and negatives of developing a web site for an outside agency. All of the emotional experiences will prepare them for the workplace environment.

The curriculum of the commercial art class should identify specific projects created in previous art classes. Articulation with the other teachers in the prerequisite art classes is important so that the students will have the opportunity to transfer their design concept learning into creating designs on the computer. This type of articulation could provide team teaching opportunities and give students in the prerequisite art classes an opportunity to do an exploration project using the computers.

Reflections created by the students are also an important tool in facilitating transfer. Any project that the students create should have tied to it an area where the students provide their reflections on the learning. During these times the teacher directs the students to "think" about areas where they found transfer occurring and areas where they could not identify transfer. Self – awareness of one's own thinking processes (metacognition) also seems to aid in transferring skills. This "thinking" about the process allows the student an opportunity to solidify their learning in their minds, which will build a sense of confidence in the student.

The goal of this research project was to improve the students' transfer of learning. The teaching of transfer, and identifying areas where transfer occurs within projects is very important in the instruction within the classroom. Students will begin to recognize situations where prior learning can be transferred into a new problem. Having a real world problem for the students to complete is also very important. The students need to see that what they are learning will be needed outside the classroom in a workplace environment. When the students experience this, the students gain confidence and motivation to tackle new problems. Students in the target class received extensive training in many different computer applications. The computers and applications used in the targeted class are the same ones used by individuals in the graphic and web industry to produce many different types of visual information for the public. It is important that the students get the experience using applications in the classroom that they may use later in the workplace. The scope of this project provided transfer of learning experiences through each phase of the learning. In summation, transfer of learning is a skill that should be taught and identified to the students in the classroom. Students will always ask the instructor when and where will they use the information that they are being taught. Transfer of learning experiences provide a means to answer those questions.

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APPENDIX A

TEACHER SURVEY

Teacher Survey

Please complete the following survey by checking either the **Yes**, **No**, or **Sometimes** box under the question.

Do students have difficulty learning computer applications?

Yes	No	Sometimes

Do students enjoy learning about different computer applications?

Yes	No	Sometimes

Do students find the work boring?

Yes	No	Sometimes

Do the students understand the manuals for the projects?

Yes	No	Sometimes

Do students follow the directions in the manuals?

Yes	No	Sometimes

Do reading levels affect their assignment completion?

Yes	No	Sometimes

Do students have trouble transferring techniques from one problem to another?

Yes	No	Sometimes

Do students need to be re-taught the basics they learned at the beginning of the course?

Yes	No	Sometimes

Do students give up easily when given a more difficult problem?

Yes	No	Sometimes

Do students ask others for help?

Yes	No	Sometimes

Do students share ideas with each other?

Yes	No	Sometimes

Do students try new projects on their own?

Yes	No	Sometimes

Do students go beyond the scope of the problem and see other applications in a problem?

Yes	No	Sometimes

Do students ask for more advanced work when assignments are done?

Yes	No	Sometimes

Do students use other programs when they finish their work?

Yes	No	Sometimes

APPENDIX B

STUDENT SURVEY

Student Survey

Please complete the following survey by checking either the **Yes**, **No** or **Sometimes** box under the question.

Do you have difficulty learning computer applications

Yes	No	Sometimes

Do you enjoy learning about different computer applications?

Yes	No	Sometimes

Do you find the learning boring?

Yes	No	Sometimes

Do you have trouble using what you have learned in one application in another?

Yes	No	Sometimes

Do you have trouble reading the manuals of computer applications?

Yes	No	Sometimes

Do you try to learn the application without reading how to do it?

Yes	No	Sometimes

Do you have to ask others frequently for help when you encounter a problem?

Yes	No	Sometimes

Do you share your knowledge of the application without being asked?

Yes	No	Sometimes

Do you enjoy the challenge of learning a new computer application?

Yes	No	Sometimes

Do you make up your own lessons or projects as a challenge?

Yes	No	Sometimes

Do you learn other applications without being told to do so?

Yes	No	Sometimes

Do you easily find similarities among different applications?

Yes	No	Sometimes

Do you prefer to do most of your work on a computer?

Yes	No	Sometimes

Do you prefer to do most of your work with pen and paper?

Yes	No	Sometimes

Do you generally receive higher grades on work that was completed on the computer?

Yes	No	Sometimes

APPENDIX C

ANECDOTAL RECORD FORM

Anecdotal Record Form

	Name	Name	Name
Using tools demonstrated during the lesson			
Sharing tool function knowledge with another student			
Using tool more creatively			
Experimenting with tool function independently			
Having difficulty using the tool correctly			
Demonstrating transfer of learning tool function on an independent design			
Collaborating with another student on design			
Transferring tool function to another problem			
Personal Reflection			

APPENDIX D

BEHAVIORAL CHECKLIST

Behavioral Checklist

Desired Social Skills	Name			Name			Name			Name		
Skill Scoring	3	2	1	3	2	1	3	2	1	3	2	1
Listening												
Sharing												
Collaborating												
No-Putdowns												
Peer Critique												
Asks appropriate questions												
Waits turn for help.												
Displays appropriate emotions when faced with a problem.												
Helps others stay on task												